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EXAMINER

MALDONADO, JULIO J

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 01/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/521,389

Applicant(s)

OKAMOTO, SHIGERU

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondenc address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE \_\_\_\_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5-7 is/are allowed.
- 6) ☒ Claim(s) 1, 2 and 4 is/are rejected.
- 7) ☒ Claim(s) 3 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishida (U.S. 4,990,997).

In re claim 1, Nishida shows in Figures 3(A)-3(F) an embedded electroconductive layer including any one of an opening part or depressed part (14) formed in an insulating film (12) on a substrate (11); a barrier layer (15/16') covering the opening part or depressed part; a metal growth promoting layer (17) on the barrier layer; and an electroconductive layer (18) embedded in the opening part or the depressed part via the barrier layer and the metal growth promoting layer (column 4, line 3 -column 6, line 58) .

In re claim 4, Nishida shows wherein the embedded electroconductive layer is a Cu layer, an Al layer, or an Al alloy having Al as a main component thereof (column 5, line 60 - column 6, line 58).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishida ('997) in view of Chiang et al. (U.S. 5,739,579).

In reference to claim 2, Nishida teaches wherein the barrier layer is one member selected from the group of TiN and TiW layers but could include other suitable materials (column 5, lines 22-32). However, Nishida fails to disclose that the barrier layer is one member selected from the group of amorphous Ti-Si-N,  $WN_x$ ,  $TaN_x$ , and  $Al_2O_3$  layers.

Nevertheless, Chiang et al. (herein referred to as Chiang) teaches, in an analogous art related to the field of semiconductor devices, that suitable equivalent materials to TiN and TiW for use as barrier layer materials include materials selected from the group of amorphous Ti-Si-N,  $WN_x$ ,  $TaN_x$  and  $Al_2O_3$  layers (column 13, lines 56-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the barrier layer of Nishida out of a material selected from the group of amorphous Ti-Si-N,  $WN_x$ ,  $TaN_x$ , and  $Al_2O_3$  as suggested by Chiang since the use of a known material on the basis of its suitability for the

intended use involves only routine skill in the art. Furthermore, the specification contains no disclosure of either the critical nature of the claimed materials or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen materials or upon another variable recited in a claim, the applicant must show that the particular materials are critical.

***Allowable Subject Matter***

5. Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
6. Claims 5-7 are allowed.
7. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of the record, Nishida (U.S. 4,990,997) shows a contact structure for connecting a semiconductor portion, including a substrate (11), an insulating film (12) an opening part (14), a ground layer (15, 17) with a thin layer of oxygen (16') between said ground layer, and an electroconductive layer (18) embedded in said opening part. However, Nishida fails to show the ground layer containing oxygen at a high concentration in the lower part and at low concentration in the upper part thereof.

Liao et al. (U.S. 5,652,464) shows an integrated circuit contact structure (Figs.1a-e) including an opening part (9), a ground layer comprising titanium

nitride (12, 12') containing oxygen, and an aluminum electroconductive layer (20) embedded in said opening part. However, Liao et al., does not teach the ground layer having a high concentration of oxygen in the lower part and a low concentration of oxygen in the upper part of said ground layer.

### ***Response to Arguments***

8. Applicant's arguments filed on 07/16/01 have been fully considered but they are not persuasive.

The applicant argues that the "barrier metal layer 15 and the interface region 16' do not satisfy the barrier metal layer on the metal growth promoting layer of claim 1 because these two layers of Nishida are not made of different materials" (page 5, second paragraph). But the applicant asserts that layer 16' is formed in the first barrier layer as part of the first barrier layer (Nishida, column 9, lines 41-42).

In response to this argument, the examiner's position is that the barrier layer includes layer 15 which is composed of TiN and layer 16' which is an oxygen-enriched region; whereas the metal growth promoting layer 17 is composed of Tin alone. Although Nishida states that a first barrier layer has a material substantially identical to that of a second barrier material (column 10, lines 4-7), which is equivalent to the "metal growth promoting layer", the two layers do not have identical materials. "Substantially identical" is not the same as

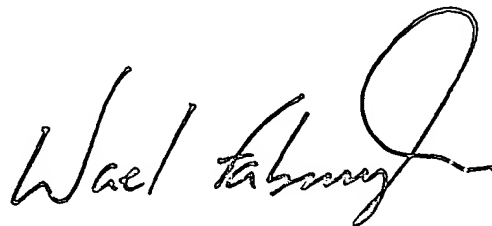
"identical". After all, Nishida does not teach that the second barrier layer include an oxygen-enriched region.

### ***Conclusion***

9. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.
10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via [julio.maldonado@uspto.gov](mailto:julio.maldonado@uspto.gov). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.
11. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.
12. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass(es): 257/751, 257635	01/07/2002
Other Documentation:	
Electronic Database(s): EAST (USPAT, EPO, JPO)	01/07/2002

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